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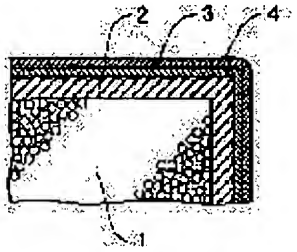
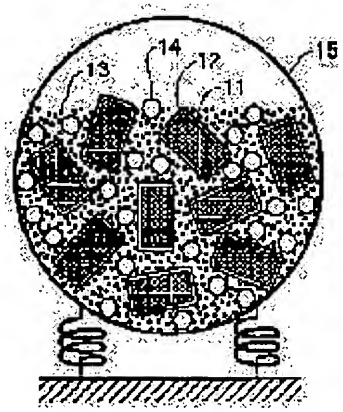
(54) CORROSION-RESISTANT RARE EARTH MAGNET AND ITS MANUFACTURE

(57)Abstract:

PURPOSE: To improve corrosion resistance of a sintered magnet and a resin bond magnet out of rare earth magnets, by forming a substratum of metal selected out of zinc, aluminum, cadmium and copper on the surface of the magnet, and covering the substratum with a chromate film.

CONSTITUTION: Rare earth magnet alloy powder is sintered or bonded by using resin binder, and a magnet shape is molded. The surface of a molded object 11 is coated with a hardening resin film 12, and put in a vessel 15 together with metal powder 13 selected out of zinc, aluminum, cadmium and copper, and medium 14 for forming a coating film. By vibrating the vessel 15 and/or stirring the inside, the metal powder is made to stick on the surface of uncured resin on the surface of the molded object 11. Hence a substratum 3 is formed and the uncured resin is cured. A chromate coating film 4 is formed on the surface of the substratum 3 by dipping the molded object 11 in aqueous solution containing chromic acid.





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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the corrosion resistance improvement of the thing which sintered the powder of a magnet alloy among rare earth permanent magnets, and the bond magnet combined with the resin binder.
[0002]
[Description of the Prior Art] Rare earth permanent magnets, such as a Sm-Co system, a Nd-Fe-B system, and an Sm-Fe-N system, are powerful magnets, and are widely used as parts, such as a loudspeaker, a motor, and a sensor. Especially, a Nd-Fe-B system magnet is the most powerful, and since raw material is comparatively cheap, the amount of manufactures is increasing.
[0003] However, it is mentioned that it is easy to corrode as a weak point of a general rare earth permanent magnet, and, especially for a Nd-Fe-B system magnet, corrosion resistance is a low. Therefore, it is necessary to carry out anti-corrosion processing on the surface of a magnet practically. Although electrodeposted coating and spray coating of an epoxy resin are usually performing anti-corrosion processing also in the bond magnet also in the sintered magnet, corrosion resistance satisfying more nearly enough [still] is not acquired.
[0004] The conditions which evaluate magnetic corrosion resistance have the exposure examination to 95%RH atmosphere in 80 degrees C as a mild thing, and have 5% brine spray test in 35 degrees C as a cruel thing. If the latter is examined, coating of the epoxy resin of the conventional Nd-Fe-B system magnet will give the corrosion resistance of about 96 hours to generating of rust. Although it is enough for the use of OA equipment or AV field, if corrosion resistance stronger against autoparts is required and it is made to a salt fog for 200 hours or more, corrosion resistance to the extent that it bears for 500 hours is desirable. However, such [until now] corrosion resistance was not realized.
[0005]
[Problem(s) to be Solved by the Invention] The purpose of this invention is to offer the bond magnet which has improved the corrosion resistance which is the weak point of a rare earth permanent magnet, and its manufacture method. Specifically, when the above-mentioned salt spray test is performed in a Nd-Fe-B system bond magnet, it is realizing corrosion resistance of 300 hours or more to rusting. Of course, the Nb-Fe-B system was not yet attained for such corrosion resistance in the bond magnet of a Sm-Co system with sufficient corrosion resistance, or an Sm-Fe-N system a little from it.
[0006]
[Means for Solving the Problem] the corrosion-resistant rare earth permanent magnet of this invention is ****** from zinc, aluminum, cadmium, and copper through covering (2) of hardening resin on the front face of the magnet (1) which sinters the powder of a rare earth permanent magnet alloy, or combines with a resin binder, and it comes to fabricate in a magnet configuration, as shown in drawing 1 -- there is a metaled ground layer (3) and it is characterized by to wear the front face of this ground layer with the clo mate coat (4)
[0007] The method of this invention of manufacturing the above-mentioned corrosion-resistant rare earth permanent magnet As shown in drawing 2 and drawing 3 , after sintering the powder of a rare earth permanent magnet alloy, or joining together with the resin binder, fabricating in a magnet configuration and covering a hardenability resin on the surface of a Plastic solid (11) (12) It puts in

in a container (15) with metaled powder (13) and a metaled covering formation medium (14). it is ****** from zinc, aluminum, cadmium, and copper -- Vibrate a container and (or) the ground layer (3) which the powder of the aforementioned metal was made to adhere to the front face of non-hardening resin covering on the front face of a Plastic solid, and was shown in drawing 1 by agitating is formed. It consists of being immersed in the solution containing a chromic acid and forming a clo mate coat (4) in the front face of the aforementioned ground layer, after stiffening non-hardening resin.

[0008] The ball of the alumina of a proper size etc. is used for a covering formation medium.

[0009] After being preferably immersed in the solution containing a chromic acid and forming a clo mate coat, the process which performs printing processing and fixes a coat is added.

[0010] The method of sintering the powder of a magnet alloy should just follow known technology. What is necessary is to also know combination with a resin binder and just to use an epoxy resin in ordinary use.

[0011] The hardenability resin which covers the front face of a sintered compact or a Plastic solid can do gill ****** from large ranges, such as phenol resin besides the epoxy resin also conventionally used for anti-corrosion covering, acrylic resin, melamine resin, an unsaturated polyester resin, and polyimide resin.

[0012]

[Function] about the sintered compact or Plastic solid which covered the hardenability resin on the front face, it is ****** from zinc, aluminum, cadmium, and copper -- if it puts into a container with metaled powder and a metaled covering formation medium, and a container is vibrated or contents are agitated, the powder of the above-mentioned metal will be clamped on the front face of a sintered compact or a Plastic solid by the covering formation medium, and will be held in the form where it was hard in the non-hardened hardenability resin layer

[0013] The technology which forms covering of a pigment is known in the name of "drum painting" by striking pigment powder by the force of a covering formation medium like alumina balls on the surface of goods within a container. In this invention, it replaces with a pigment, a metal powder is used, and the layer of a metal powder is formed in a front face by [which is the hardenability resin which covered the front face of the sintered compact which is the material of a bond magnet about this, or a Plastic solid] making it hard a surface.

[0014] since each above-mentioned metal is soft, if it is clamped on a Plastic-solid front face with the alumina balls the powder of whose is a covering formation medium -- the layer of a hardenability resin -- it deforms plastically and it is not only hard, but becomes a flat form Consequently, the front face of the sintered compact after repeating a sufficient vibration and sufficient churning, or a Plastic solid presents appearance which was uniformly covered continuously by the thin layer of the above-mentioned metal.

[0015] Thus, if the sintered compact or Plastic solid in which the ground layer was formed is immersed in chromic-acid content solution, a clo mate coat will be formed in the front face of a metal-substrate layer. This processing is one chromate treatment of the surface treatment technology which raises the corrosion resistance of metal goods, and concrete technique should just follow known technology. A clo mate coat turns into a coat which this also followed on substance, as a result of being formed in the place where the ground layer continued on substance as mentioned above, and corrosion resistance is demonstrated. A clo mate coat is stabilized when this also carries out known printing processing, and it makes corrosion resistance continuous.

[0016]

[Example]

[Example 1] By weight %, alloy composition dissolved the magnet alloy of 28Nd(s)-1.0B-5.0Co-** Fe by the high frequency induction furnace, poured and quenched on the water-cooled copper roll which rotates at high speed, and considered as the thin band. After grinding this to the powder which passes a 250-micrometer sieve, it heat-treated under argon gas atmosphere at 620 degrees C for 1 hour.

[0017] In this way, an epoxy resin is added 2% of the weight as a binder to the obtained magnet-alloy powder, and it mixes to it, and is 2 7t/cm. By the pressure, press forming was carried out to the ring-like object with an outer-diameter [of 20mm] x bore [of 18mm] x height of 5mm. It heated at

150 degrees C for 1 hour, and they was made to harden an epoxy resin binder.
[0018] In the solution which dissolved the epoxy resin in MEK (methyl ethyl ketone) of 1:9 by the weight ratio, it was immersed, the above-mentioned Plastic solid was pulled up, and the non-hardened epoxy resin layer was formed in the front face.
[0019] 20 above-mentioned Plastic-solids, 10g [of zinc powder] (3 micrometers of mean particle diameters), and ball 1kg made from an alumina with a diameter of 3mm was supplied in the drum with a bore [of 120mm] x length of 200mm, and it was made to vibrate for 10 minutes by part for amplitude [of 5mm], and 200 vibration frequency/.
[0020] Contents were taken out from the drum, the Plastic solid by which the zincky ground layer was formed in the front face was taken out, it heated at 150 degrees C for 1 hour, and the surface epoxy resin was stiffened.
[0021] The Plastic solid which stiffened epoxy resin covering was immersed in chromic-acid solution 20%, after performing chromate treatment, it pulled up, and printing heated for 30 minutes at 180 degrees C was performed. The formed clo mate coat is 15 micrometers in thickness, and was making the layer on the front face continuously on substance.
[0022] The salt spray test was performed 5% with the mere bond magnet which skipped the process after epoxy resin surface coating prepared for comparison, and the thing which gave known epoxy resin electrodeposition covering. The result is as follows. : Time to rust generating Example 1 (processing [no]) of comparison 4 hours Example 2 (epoxy resin electrodeposition covering) of comparison 96 hours Example 1 With no 500-hour rusting.
[0023] [Example 2] Similarly the magnet alloy of 30%Nd-1%B-2.5%Co-** Fe was ingoted by the weight, and powder was manufactured like the example 1.
[0024] the temperature same after making this magnet-alloy powder sinter with a hotpress at the temperature of 750 degrees C -- 55% of reduction of area -- it set, lump processing was performed and the disc-like Plastic solid with a diameter [of 20mm] x height of 5mm was obtained
[0025] Covering of an epoxy resin is formed in the front face of this Plastic solid like an example 1, the powder of the alloy of zinc and tin covers by the same operation as an example 1, a ground layer is built, it heated at 150 degrees C for 1 hour, and they was made to harden an epoxy resin.
[0026] Printing for [chromate treatment / which is flooded with the 10% alcoholic solution of a chromic acid / and 180 degree-Cx] 30 minutes was performed.
[0027] The thing with the sintered compact of magnet-alloy powder, the thing which carried out electrodeposted covering of an epoxy resin, and the thing which gave nickel plating to the sintered compact were prepared for comparison. The salt spray test was presented with the corrosion-resistant magnet of this invention 5% with them. A result is as follows. : Time to rusting Example 3 (processing [no]) of comparison 4 hours Example 4 (epoxy resin electrodeposition covering) of comparison 96 hours Example 5 (nickel plating) of comparison 96 hours Example 2 With no 500-hour rusting.
[0028]
[Effect of the Invention] The corrosion-resistant rare earth permanent magnet of this invention shows high corrosion resistance without rusting in a salt spray test for 500 hours 5%. Therefore, this invention is used under severe service conditions, such as autoparts, and makes a rare earth permanent magnet highly efficient as a magnet usable also for the use as which corrosion resistance high for the reason is required.
[0029] The manufacture method of the corrosion-resistant rare earth permanent magnet of this invention is comparatively easy, and since there are few handling processes and automation is easy, it can carry out a process, without raising cost.

[Translation done.]